

Application No. 10/828,521
Reply to Office Action of April 18, 2007

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REMARKS

Applicant notes with appreciation the rejoinder of claims 12 and 14-20. Currently, claims 1, 2, 4-12, and 14-20 are pending in the application. By way of this amendment the only independent claims, independent claims 1 and 12, have been amended to recite an ion exchange capacity for the inventive copolymer composition. Support for this amendment is found in paragraph [0020] of the specification as filed. Additionally, claim 20 has been amended to improve the antecedent basis of the "total block copolymer" and finds support in, among other places, claim 12 as originally filed. As such, it is submitted that no new matter has been added by way of this amendment.

Currently, the pending claims stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tan et al. (U.S. Patent 6,579,948). Additionally, the pending claims all are rejected under 35 U.S.C. §103(a) as being unpatentable over Tan et al. in view of Storey et al. (U.S. Patent 5,039,752). Lastly, all the pending claims stand rejected under 35 U.S.C. §103(a) over Tan et al. in view of Murata et al. (U.S. Patent 3,553,286).

Remarks Directed to Rejection of Pending Claims under 35 U.S.C. §103(a) as Being Obvious over Tan et al.

The basis of the rejection of the pending claims over Tan et al. is that a cation according to the pending claims is not restricted to preclude a proton and further that the degree of sulfonation found in pending independent claims 1 and 12 does not clearly distinguish over the maximal 70% styrene sulfonation as taught by Tan et al.

In response to this rejection, the mol percentage of monomer being sulfonated has been recited with greater clarity. Applicant submits that the increased degree of sulfonation is itself entitled to patentable weight on the basis that one of ordinary skill in the art at the time the

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present invention was made considered sulfonation levels of in particular styrene monomer present in a copolymer (A or A') above 70 mol percent to be impractical or impossible in part due to concerns regarding solubility and the effects of precipitation on the sulfonation process. (See specification paragraph [0019]).

Additionally, independent claims 1 and 12 have been amended to recite a degree of ion exchange capacity of between 1.78 and 2.04 milliequivalents per gram of inventive copolymer composition. The degree of ion exchange capacity is submitted to have direct implications in the suitability of a composition for use as a selectively permeable membrane material. The values of ion exchange capacity recited in the pending claims exceed those for materials produced according to Tan et al. and as such are submitted to represent a separate basis for the allowability of the pending claims over Tan et al. The declaration of Eugene Napadensky made of record on January 26, 2007 in section 7 includes the actual data on which the Tan et al. reference was based and shows a maximal ion exchange capacity (IEC) of 1.41 milliequivalents per gram for a sample of composition sulfated to 58 mol percent. The substance of this declaration is hereby incorporated by reference.

As the pending claims are currently directed to compositions that exceed those taught in Tan et al. as to the mol percentage of sulfonation and the ion exchange capacity of the resulting composition, it is respectfully requested that these claim recitations are entitled to patentable weight. The fact that the inventive sulfonation levels are achieved in spite of decreased composition solubility and that these inventive sulfonation levels above 70 mol percent contribute to a higher ion exchange capacity afford additional support that the claimed invention is nonobvious over Tan et al.

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In light of the above amendments and remarks, reconsideration and withdrawal of the rejection as to the pending claims under 35 U.S.C. §103(a) over Tan et al. is requested.

**Remarks Directed to Rejection of Pending Claims
under 35 U.S.C. §103(a) over Tan et al. in View of Storey et al.**

This rejection was originally articulated in Paper No. 20060915, section 12. In response to this rejection as an initial matter, Applicant reiterates that the claim recitation of B being polyisobutylene is sufficient to distinguish the pending claims from Tan et al. in view of Storey et al. and as such, Applicant hereby incorporates by reference the remarks made of record on pages 10 and 11 of the amendment filed January 26, 2007, as well as the declaration of Eugene Napadensky.

Additionally, based on the above-recited deficiencies of Tan et al. with respect to the pending claims as to ion exchange capacity and the failure of Storey et al. to bolster these deficiencies of Tan et al., Applicant submits that the pending claims are indeed patentable over the prior art reference combination of Tan et al. in view of Storey et al.

In light of the above remarks, reconsideration and withdrawal of the rejection as to claims 1, 2, 5-12 and 14-20 under 35 U.S.C. §103(a) over Tan et al. in view of Storey et al. is requested.

**Remarks Directed to Rejection of Pending Claims
under 35 U.S.C. §103(a) over Tan et al. in View of Murata et al.**

Murata is cited for the teaching of a sulfonated polystyrene having a degree of sulfonation of 84.2% with reference to column 4, line 59 (Paper No. 20070412, page 5, section 11). The basis of this rejection is the modification of Tan et al. to include the sulfonation level of Murata.

In response to this rejection, Applicant hereby incorporates by reference the above remarks with respect to the deficiencies in the teachings of Tan et al. and submits that Murata et

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al. fails to bolster a lacking in the teaching of Tan et al. and as such represents a sufficient basis for withdrawal of this rejection.

Additionally, it is respectfully submitted that the prior art combination of Tan et al. and Murata et al. fails to afford the claimed invention. In this regard, Tan et al., like the pending claims, teaches a copolymer having a block of sulfonated copolymer such as polystyrene copolymerized with a second block of polyisobutylene. It is submitted that Murata et al., while teaching a sulfonated polystyrene with a degree of sulfonation of as high as 84.2% on a mol basis, teaches only a mixture and not copolymerization of sulfonated polymer with polyamide. In support of this assertion, Murata et al. at column 3, lines 11-23, indicates that the mixture of sulfonated vinyl polymer does not obstruct polyamide polymerization and in fact appears to promote such polymerization. Additionally, Murata et al. teaches at column 3, line 64 – column 4, line 3 that sulfonated polymer is mixed polyamide after polymerization or is present during the polymerization to function as a catalyst but nowhere does Murata et al. teach that the sulfonated polymer forms a copolymer with the polyamide. Instead, Murata et al. is submitted to teach only a mixture of dissimilar polymers: one sulfonated vinyl and the other polyamide.

It is submitted that the prior art combination fails to produce a highly sulfonated copolymer beyond the level of Tan et al. since Murata et al. provides only a mixture of two chemically distinct polymers including one that is highly sulfonated, and the claimed copolymer. Support for this assertion with respect to the pending claims is found in the application as filed at paragraph [0019] regarding the lack of solubility associated with an increased sulfonation level. A highly sulfonated polymer lacking the isobutylene copolymer segments per the pending claims would be expected to be immiscible with a polyisobutylene polymer mixed with a highly sulfonated polymer per Murata et al. and as a result form at best distinct domains of each type of

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polymer thereby forming preferential paths of ion movement through a membrane formed of this hypothetical material that would necessarily lack the ion exchange capacity of the pending claims.

As Tan et al. is silent as to how to form a copolymer of polyisobutylene and a sulfonated copolymer block beyond 70 mol percent sulfonation and Murata et al. is silent as to copolymerization of two mixed polymers, one of which is highly sulfonated, it is submitted that the prior art reference combination fails to afford the claimed invention.

In view of the above remarks, reconsideration and withdrawal of the rejection as to the pending claims under 35 U.S.C. §103(a) over Tan et al. in view of Murata et al. is requested.

Summary

Claims 1, 2, 5-12 and 14-20 are the claims pending in this application. Each claim is believed to be in allowable form and directed to patentable subject matter. Reconsideration and withdrawal of the rejections and the passing of this application to allowance are requested. Should the Examiner have any suggestions as to how improve the form of any of the pending claims, it is respectfully requested that the undersigned attorney in charge of this application be contacted at the telephone number given below.

Dated: July 17, 2007

Respectfully submitted,

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